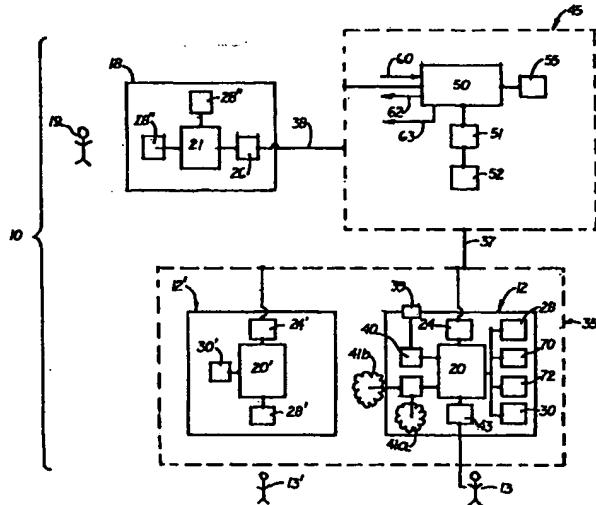




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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## (54) Title: A MOTOR VEHICLE ENTERTAINMENT SYSTEM



## (57) Abstract

An interactive entertainment system (10) for occupants in a motor vehicle (12). The system (10) includes a motor vehicle (12) with an electronic device (20) connected to a wide area network (45) via a wireless communication network. The electronic device (20) is coupled to various sensors (40, 41a, 41b, 43) designed to detect a functioning aspect of the motor vehicle (12), the environment, or the occupant, respectively. During operation, the electronic device (20) is able to upload real time information from the sensors to the wide area network (45). Connected to the wide area network (45) is a central computer (50) loaded with an interactive software program (52) capable of receiving the real time data from the electronic device (20). During use, an occupant (13) uses the electronic device (20) to connect to the wide area network (45) and to the central computer (50), and play the interactive software program (52).

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**TITLE: A MOTOR VEHICLE ENTERTAINMENT SYSTEM****TECHNICAL FIELD**

This invention relates to interactive entertainment computer games and, more particularly, to such games designed for occupants in a motor vehicle.

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**BACKGROUND ART**

Today, wireless communication networks enable occupants in motor vehicles to communicate with anyone located around the world. More recently, a wide range of electronic devices have become available that enable occupants in motor vehicles to connect to a world wide computer network, such as the INTERNET, using the wireless communication network.

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It is common for motor vehicle manufacturers to include electronic devices in their motor vehicles that are coupled to sensors in the motor vehicle that monitor various electrical and mechanical systems in the motor vehicle. Recently, some manufacturers have included wireless communication devices that are able to upload and download real time information from the motor vehicle to a remote computer operated by the motor vehicle manufacturer, (see ONSTAR assistant program available through Cadillac Division of General Motors of Detroit Michigan). These remote computers are able to diagnosis problems in the motor vehicle and then transmit commands to the motor vehicle that control targeted systems in the motor vehicle, such as the motor vehicle's electrical or fuel systems.

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Today, it is a well known fact that traffic conditions are worsening throughout the United States and Canada, and that individuals are spending more time in their motor vehicles. Individuals often spend two to three hours each day computing to and from work. Many of these individuals are passengers that are able to operate

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electronic devices while traveling. An entertainment system designed for occupants in a motor vehicle that can download real time data from the motor vehicle, the occupant, or the environment to a central computer that uses the data in an interactive software game that can be played by the occupant against the central computer or against occupants in other motor vehicles, or against users in fixed locations, would be highly desirable.

35

**DISCLOSURE OF THE INVENTION**

It is an object of the present invention to provide an interactive entertainment system for occupants in a motor vehicle.

5 It is another object of the present invention to provide such a system that uses real time data collected from the motor vehicle, the occupant or the environment.

It is a further object of the present invention to provide such a system that transmits the information across a wireless communication network to a wide area computer network.

10 It is a still further object of the invention to provide such a system that includes a central computer connected to the wide area computer network that can be used to upload and process real time data from the motor vehicle and incorporate it into an interactive software program that can be played by the occupant.

These and other objects are met by an entertainment system for occupants in  
15 motor vehicles disclosed herein, that includes an electronic device located inside a motor vehicle, coupled to wireless communication means that enable it to communicate with a wireless communication network. The electronic device is also coupled to various sensors capable of detecting current information regarding various systems and functions of the motor vehicle, the environment, or the occupant. The  
20 first group of sensors, known as motor vehicle-related sensors, may include sensors currently used with on-board diagnostic systems. These sensors may include sensors coupled to switches that control various electrical components used in the motor vehicle, such as the radio volume control switch, the heater fan switch, the electric windows control switch, or the window wiper controls switch, etc. The second group  
25 of sensors, known as environmental sensors, may include temperature or humidity sensors located inside and outside the motor vehicle that are capable of detecting the temperature and humidity, respectively. The third group of sensors, known as occupant-related sensors, are typically attached directly to the occupant, and may include temperature or heart rate monitors.

30 The electronic device may also be connected to an optional physical location means enabling the physical location of the electronic device, and hence, the motor vehicle, to be instantaneously determined.

During use, the wireless communication network is used to connect the electronic device to a wide area computer network, such as the INTERNET. The  
35 system further includes a central computer coupled to the wide area computer network capable of connecting to a plurality of electronic devices and downloading and uploading information therefrom. The central computer has an interactive software program loaded into its memory capable of using the downloaded information from

5 each electronic device and incorporating it into the software program. Each electronic device has a client-side software program loaded into its memory that enables the occupant or user to connect to and communicate with the central computer. The client-side software program is also used to selectively collect inputted information from the occupant, and real time data from the motor vehicle-related sensors, the  
10 environmental sensors, or the occupant sensors, and upload the information and data over the wide area network and to the central computer. The central computer then processes the information and data and uses it in the interactive software program. The interactive software program may transmit responses to the occupant or to other occupants located in other motor vehicles, or to other users located in fixed locations  
15 also connected to the central computer.

An optional function control means is provided between the electronic device and the various electrical systems in the motor vehicle that enables the central computer to selectively operate the electrical systems in the motor vehicle remotely. During use, a selected electrical system may be operated by the central computer  
20 when no response or an improper response is inputted by the occupant or user when the game is in progress.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a flow chart diagram of the motor vehicle entertainment system  
25 described herein.

#### BEST MODE FOR CARRYING OUT THE INVENTION

As shown in Fig. 1, there is illustrated an entertainment system 10 for an occupant 13 in a motor vehicle 12 that enables him or her to use an electronic device  
30 20 to play an interactive software program 52 loaded into the memory of a remote central computer 50. The interactive software program 52 receives the inputted commands from the occupant 13 and/or real time data from motor vehicle-related sensors 40 located in the motor vehicle 12, or from environment sensors 41a, 41b located inside or outside the motor vehicle 12, or from occupant sensors 43 directly  
35 attached to the occupant 13. The interactive software program 52 then processes the information and data and transmits a response back to the electronic device 20. The response may include a command that controls a specific system in the motor vehicle 12. The occupant 13 may play the interactive software program 52 directly against

5 the central computer 50, against other occupants 13' located in other motor vehicles-12', or against users 19 located in fixed locations 18.

The electronic device 20 is located inside the motor vehicle 12 and coupled to various sensors 40, 41a, 41b, and 43, each capable of detecting and transmitting information to the electronic device 20. The first group of sensors, known as motor vehicle-related sensors 40, are used to measure some function or system in the motor vehicle 12. Examples of such sensors 40 include sensors used in the motor vehicle's on-board diagnostic system, the heater control switch, the radio volume control switch, the electric window control switch, etc., all denoted 39. Typically, the sensor 40 interfaces with the motor vehicle's OBD II connector, which controls the flow of electric current to switches that control the operation of various electrical systems in the motor vehicle 12. The exact method of interfacing the electronic device, sensors and functions may be determined by reviewing the ONSTAR system, referenced above and now incorporated herein.

A second group of sensors, known as environmental sensors 41a, 41b are used to measure some environmental parameter, such as the inside and outside temperature or humidity. Typically, the environmental sensors 41a, 41b are temperature or humidity sensors commonly provided by the motor vehicle manufacturer, which also may be coupled to the OBD II.

The third group of sensors, known as occupant sensors 43, are directly connected to the occupant 13 to measure some physiological parameter, such as pulse or blood pressure of the occupant 13. Examples of such devices are sold under the trademarks STATEVIEW, MOBILEVIEW and ALARMVIEW by DataCritical Company, located in Seattle, Washington.

The system 10, shown in Fig. 1, is designed to be used by occupants 13, 13' in first and second motor vehicles 12, 12' or by users 19 located in fixed locations 18. The electronic devices 20, 20' in the motor vehicles 12, 12' are connected to wireless modems 24, 24' that enable them to communicate with the wireless communication network 35. A communication link 37 is then used to connect the wireless communication network 35 to a wide area network 45, such as the INTERNET. The electronic devices 20, 20' may be a laptop computer or a manufacturer-installed, on-board computer.

Optionally, each electronic device 20, 20' may be coupled to a functional control means used to control a targeted system or function in the motor vehicle 12.

5 Such control means may be software instructions and connection means between the electronic device 20 and various motor vehicle electrical circuits, such as the power window circuit, designated 70 or heater control circuit 72. During operation, the control means may be activated by the central computer 50 to control an electric circuit 70, 72 when playing the interactive software program 52.

10 Each electronic device 20, 20' may also be connected to an optional physical location means enabling the physical location of the electronic device 20, 20' and hence, the motor vehicle 12, 12', respectively, to be instantaneously determined. In the preferred embodiment, each physical location indicating means is a global positioning satellite receiver 30, 30', which receives global coordinate information from transmitters located in overhead satellites.

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The global positioning system (GPS) is a location system based on a constellation of twenty-four satellites orbiting the earth at altitudes of approximately 11,000 miles. The GPS satellites provide accurate positioning information twenty-four hours per day, anywhere in the world. GPS uses a receiver which stores orbit information at all GPS satellites. During use, a land-based receiver determines the time and the positions of the overhead satellites and then calculates the amount of time it takes a GPS radio signal to travel from the satellites to the receiver. By measuring the amount of time it takes for a radio signal to travel from the satellites, the exact location of the GPS receiver can be determined. GPS receivers 30 are available from Corvallis Microtechnology, Inc., in Corvallis, Oregon. It should be understood however, that other means for automatically determining the user's physical location may be used, such as information from the user's cellular telephone.

As discussed above, the system 10 includes a central computer 50 connected to the wide area network 45. The central computer 50 is able to communicate with a plurality of electronic devices 20, 20' and 21 connected to the wide area network 45. Loaded into the memory of the central computer 50 is an interactive software program 52 capable of uploading and processing data from the electronic devices 20, 20', 21 located in different motor vehicles 12, 12' or in fixed locations 18, respectively. In the preferred embodiment, the interactive software program 52 is a simple interactive game, such as Hangman, that the occupants 13, 13', and 19 play using their electronic devices 20, 20' and 21, respectively. It should be understood, however, that more complicated software games may be developed and used with the system 10.

5        Loaded into the memory of each electronic device 20, 20', 21, is a client side  
software program 28, 28', 28" that is able to communicate with the central computer  
50. The client side software program 28 processes any inputted information from the  
occupant or user, and the data from the sensors 40, 41, 43 and transmits them to the  
central computer 50. When the inputted information and real time data are received,  
10      the central computer 50 processes the information and data into the interactive  
software program 52. If an improper command or data is sent to the central computer  
50, the interactive software program 52 may transmit a response command to one or  
both electronic devices 20, 20' or to electronic devices 21' operated by users 19  
located in fixed locations 18.

15      In addition to receiving and transmitting information to and between the  
central computer 50, the client side software program 28 may also be used to transmit  
physical location information from the GPS, and the date and time information  
available from the BIOS of the electronic device 20. When the electronic device 20 is  
connected to the wide area network 45, the client side software program 28  
20      automatically downloads the user's name, password, location, and time information to  
the central computer 50.

During use, the central computer 50 creates a database 55 of authorized users  
of the system 10. The database 55 contains information regarding the name, address,  
and e-mail address of each occupant or user, the make and year of the motor vehicle,  
25      and GPS and password information. When initially connecting to the central  
computer 50, authorized occupants or users submit a user name and password and  
then select a desired interactive software program 52 from a library 51 of interactive  
software programs available to the central computer 50.

Fig. 1 shows two occupants 13, 13' located in two separate motor vehicles  
30      hereinafter referred to as first and second motor vehicles 12, 12', respectively, and a  
third user 19 located in fixed location 18. All the occupants 13, 13' and user 19 are  
shown using an electronic device 20, 20', and 21, respectively, capable of connecting  
to the wide area network 45 and to the central computer 50. The electronic devices  
20, 20' are connected to a wireless modem 24, 24', respectively, each capable of  
35      connecting to a wireless communication network, generally referred to as 35. Each  
wireless communication network 35 may be connected to the wide area network 45  
via a landline communication link, generally referred to as 37. In the fixed location  
18, the electronic device 21' is connected to a wired connection 26, which can include

5 an analog modem connected to a standard landline communication link 38 or a digital modem connected to a digital subscription line (DSL) that connects to the wide area network 45. The first and second motor vehicles 12, 12' are both shown to include optional physical GPS receivers 30, 30', respectively, which may be used to establish their locations when connected to the central computer 50.

10 In order to use the system 10, the user's network address must be known to the central computer 50 so that information may be downloaded to the occupant's electronic devices, 20, 20' or 21, respectively. If the central computer 50 is also the user's network service provider to the wide area network 45 and a previously established account has been set up on the central computer 50, the numerical or

15 temporary address would be known to the central computer 50 when the occupant 13, 13' or user 19 signs onto the central computer 50. If the occupant or user does not have a previously established account on the central computer 50, then the client side software program 28, 28', 28" must be used to collect and transfer the information to the central computer 50 each time the occupant 13, 13' or user 19, respectively, signs

20 onto the computer 50. In the preferred embodiment, the client side software program 28, 28', 28" used with each electronic device 20, 20' and 21 is able to communicate with the interactive software program 52 that enables the occupant or user to enter personal ID information, billing information and network addresses and settings.

25 During use, the occupant's or user's personal information is entered into the client side software program 28, 28', 28". When initial contact is made with the central computer 50, the personal information is automatically downloaded to the central computer 50. The central computer 50 then temporarily creates an account for the occupant 13, 13' or user 19. The client side software program 28, 28', 28" may be a proprietary software program or an INTERNET browser software program.

30 After the account information has been confirmed or set up on the central computer 50, the occupants 13, 13' or user 19 may begin playing the interactive software program 52 on the central computer 50. When playing the game, responses 60 are inputted to the computer and responses 62 are sent to the occupants and users. When a proper response is submitted to the central computer 50, the central computer

35 50 may transmit a correct response signal to the electronic device 20, 20' or 21. When an improper response is submitted, the central computer 50 may respond by sending an incorrect response signal to electronic device 20 that submitted the response or to the other user's electronic device 20'.

5        In some instances, the signal may include control command 63 intended to -  
control a targeted function such as OBDII 39 or an electric circuit 70, 72 in the motor  
vehicle 12 or 12'. For example, when an improper response 60 is submitted to the  
central computer 50, a control command 63 may be sent to the electronic device 20  
instructing it to activate the switch to decrease or increase the targeted function 39,  
10      70, or 72.

An important feature of the system 10 is that authorized users 19 located in  
fixed locations 18 can play the interactive software program 52 and have their  
responses transmitted to an occupant's motor vehicle 12 or 12'.

In compliance with the statute, the invention, described herein, has been  
15      described in language more or less specific as to structural features. It should be  
understood, however, the invention is not limited to the specific features shown, since  
the means and construction shown comprise only the preferred embodiments for  
putting the invention into effect. The invention is, therefore, claimed in any of its  
forms or modifications within the legitimate and valid scope of the amended claims,  
20      appropriately interpreted in accordance with the doctrine of equivalents.

#### INDUSTRIAL APPLICABILITY

This invention will have wide application in the motor vehicle, software  
program, and INTERNET service industries.

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**CLAIMS****I claim:**

1. A motor vehicle occupant entertainment system (10), comprising:
  - a. a wide area network (45);
  - b. a central computer (50) connected to said wide area network;
  - c. an electronic device (20) located in a motor vehicle (12);
  - d. a wireless communication means disposed between said electronic device (20) and said wide area network (45), thereby enabling said electronic device (20) to transmit and receive data from said central computer (50) over said wide area network (45), and;
  - e. at least one sensor coupled to said electronic device (20) capable of detecting real time data and transmitting to said electronic device (20) for transmission to said central computer (50), and;
  - f. an interactive software program (52) loaded into said central computer (50), said interactive software program (52) capable of processing data collected from said sensor and uploaded from said electronic devices (20).
2. An entertainment system as recited in Claim 1, wherein said sensor is a motor vehicle-related sensor (40) able to detect motor vehicle information.
- 25 3. An entertainment system as recited in Claim 2, further including means to control a targeted function of said motor vehicle (12).
4. An entertainment system as recited in Claim 2, wherein said sensor is an environmental sensor 41a, 41b able to detect environmental information.
- 30 5. An entertainment system as recited in Claim 4, further including means to control a function of said motor vehicle (12).
6. An entertainment system as recited in Claim 1, wherein said sensor is an occupant sensor 43 able to detect occupant information.
- 35 7. An entertainment system as recited in Claim 1, further including means to control a function of said motor vehicle (12).

5 8. A motor vehicle occupant entertainment system, comprising:

- a. a wide area network (45);
- b. a central computer (50) connected to said wide area network (45);
- c. an electronic device (20) located in a motor vehicle (12);
- d. a location detecting means connected to said electronic device (12);
- 10 e. a wireless communication means disposed between said electronic device (12) and said wide area network (45), thereby enabling said electronic device (12) to transmit and receive data from said central computer (50) over said wide area network (45), and;
- f. at least one sensor coupled to said electronic device (20) capable of detecting real time data and transmitting data to said electronic device (12) for transmission to said central computer (50);
- 15 g. means to control a function of said motor vehicle (12), and;
- h. an interactive software program (52) loaded into said central computer (50), said interactive software program (52) capable of processing data uploaded from said electronic devices (20) and controlling at least one 20 said function of said motor vehicle (12).

9. An entertainment system as recited in Claim 8, wherein said sensor is a motor vehicle-related sensor (40) able to detect motor vehicle information.

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10. An entertainment system as recited in Claim 8, wherein said sensor is an environmental sensor (41a), (41b) able to detect environmental information.

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11. An entertainment system as recited in Claim 8, wherein said sensor is an occupant sensor (43) able to detect occupant information.

12. An entertainment system, as recited in Claim 8, further including a database (55) connected to said central computer (50) containing manufacturing specification information of a said motor vehicle (12).

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13. A motor vehicle occupant entertainment system, comprising:

- a. a wide area network (45);
- b. a central computer (50) connected to said wide area network (45);

5       c. a first motor vehicle (12), said first motor vehicle (12) including an electronic device (20);

10      d. a wireless communication means connected to said electronic device (20) enabling said electronic device (20) to connect to said wide area network (45) and transmit and receive data from said central computer (50) when connected to said wide area network (45);

15      e. at least one sensor coupled to said electronic device (20) capable of detecting real time data from said first motor vehicle (12) and transmitting said data to said electronic device (20) for transmission over said wide area network (45) to said central computer;

20      f. a second motor vehicle (12'), said second motor vehicle (12') including an electronic device (20');

25      g. a wireless communication means disposed between said second electronic device (20') and said wide area network (45), thereby enabling said second electronic device (20') to transmit and receive data from said central computer (50) when connected to said wide area network (45), and;

30      h. an interactive software program (52) loaded into said central computer (50), said interactive software program (52) capable of processing data uploaded from first and second electronic devices (20), (20').

25      14. A motor vehicle occupant entertainment system, as recited in Claim 13, further including means to control a targeted function in said first or second motor vehicle (12), (12').

30      15. A motor vehicle occupant entertainment system, as recited in Claim 14, wherein said means to control a targeted function is coupled to said interactive software program (52).

35      16. An entertainment system as recited in Claim 15, further including means to control a function of said first motor vehicle (12).

17. An entertainment system as recited in Claim 15, wherein said sensor is an environmental sensor (41a), (41b) able to detect environmental information.

5      18. An entertainment system as recited in Claim 15, further including means to  
control a function of said motor vehicle (12).

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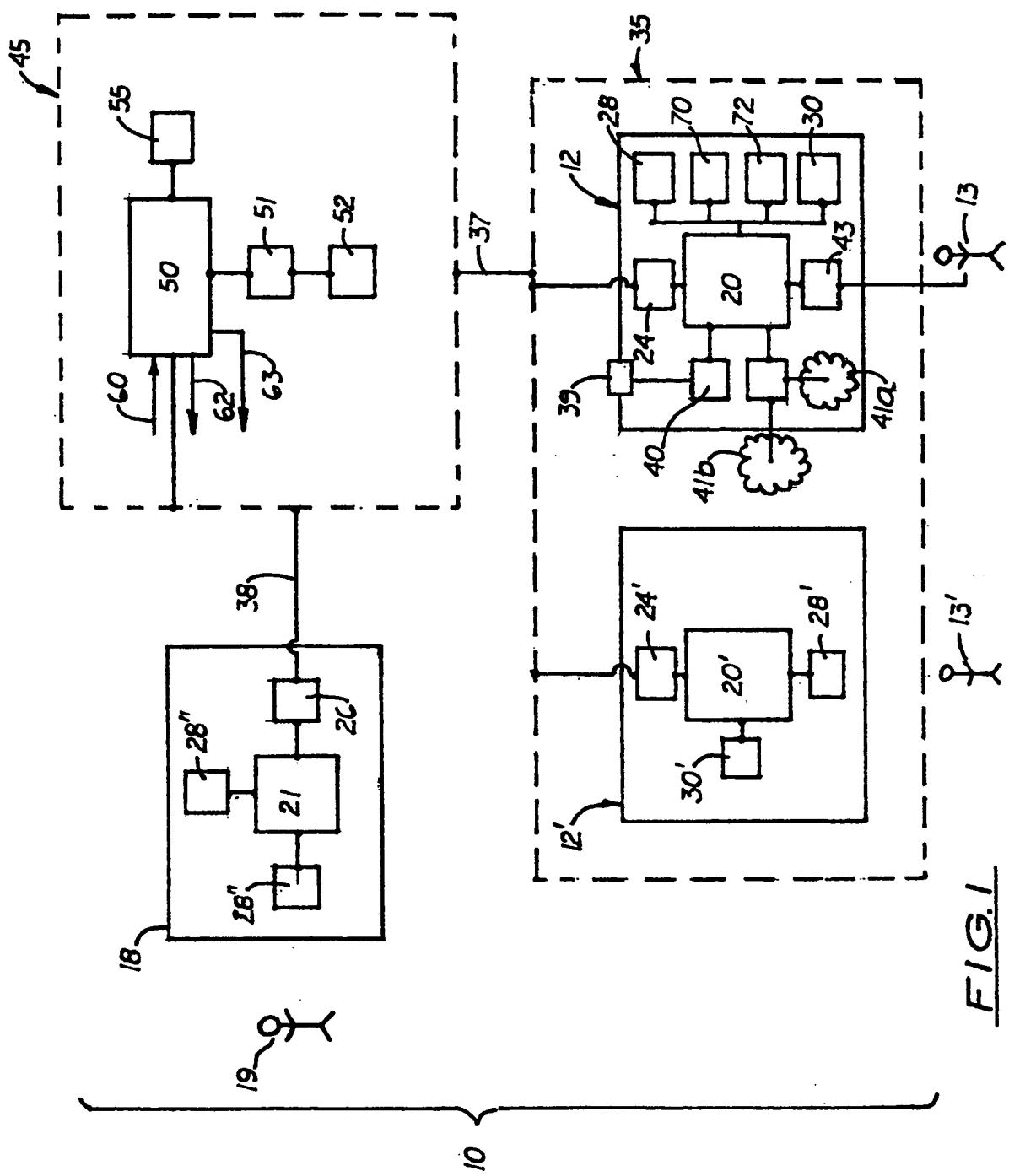
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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/26873

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A63F 9/22

US CL : 463/42

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 463/40, 41, 42, 36; 370/270, 271, 278; 180/271; 340/438; 701/24,33,36

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

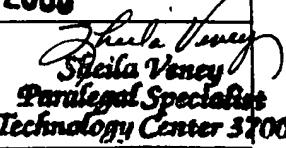
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| Y         | US 5,794,164 A (BECKERT et al) 11 August 1998, see entire document                 | 1-18                  |
| Y         | US 5,660,246 A (KAMAN) 26 August 1997, see entire document                         | 1-18                  |
| Y,P       | US 5,957,985 A (WONG et al) 28 September 1999, see entire document                 | 1-18                  |
| Y         | US 5,362,069 A (HALL-TIPPING) 08 November 1994, see entire document                | 2-6,9-11,16 -18       |
| A         | US 4,958,381 A (TOYOSHIMA) 18 September 1990, see entire document                  | 1, 8, 13              |

Further documents are listed in the continuation of Box C.  See patent family annex.

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## INTERNATIONAL SEARCH REPORT

International application No.

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| Y         | US 5,586,257 A (PERLMAN) 17 DECEMBER 1996, see entire document                     | 1-18                  |
| A,P       | US 5,825,283 A (CAMHI) 20 October 1998, see entire document                        | 6, 7, 11              |
| Y,E       | US 6,009,363 A (BECKERT et al) 28 December 1999, see entire document               | 1-18                  |
| Y         | US 5,729,452 A (SMITH et al) 17 March 1998, see entire document                    | 12                    |